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Abstract

I use novel data collected from annual 10-K SEC filings to examine the role of bank lines of credit in the liquidity management of public corporations. I find that bank lines of credit account for a large share of liquidity only for firms with a historical record of profitability. Firms with low profitability that are unable to obtain a line of credit more heavily use cash in their corporate liquidity management; they hold higher balances of cash and save more cash out of cash flow than firms that are able to obtain a line of credit. Even among firms that obtain lines of credit, banks use financial covenants on profitability to restrict access when firms experience drops in performance. The credit restriction is temporary and firms eventually regain full access to their line of credit.

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Public firms in the United States utilize bank lines of credit, or revolving credit facilities, more than any other debt instrument. Draw downs on lines of credit represent almost 30 percent of aggregate debt outstanding for public firms. Over 80 percent of bank financing extended to public firms is in the form of lines of credit, and unused lines of credit on corporate balance sheets represent 10 percent of total assets. Firms' annual reports and research by credit rating agencies suggest that the availability of lines of credit is instrumental in the management of corporate liquidity and the reduction of default risk. In addition, theoretical research suggests that bank lines of credit play an important role in policy decisions. For example, Holmstrom and Tirole (1998) emphasize the importance of bank lines of credit in their discussion of the provision of liquidity by the government; Morgan (1994) emphasizes the importance of bank lines of credit in the transmission of monetary policy through the banking sector. Despite the importance of bank lines of credit in theory and practice, the absence of data has limited the existing empirical research on their role in corporate financing decisions.

This paper conducts one of the first empirical studies of the use of bank lines of credit in the corporate finance decisions of a large sample of public firms. I use a unique data set, constructed from information collected from annual 10-K SEC filings, which documents the sources of corporate debt and the availability of bank lines of credit. I explore 3 issues. First, I explore how bank lines of credit fit into the overall corporate liquidity management of public firms. More specifically, I examine the factors that govern whether firms use internal sources of liquidity (cash) versus external sources of liquidity (lines of credit). Second, I explore the degree to which lines of credit represent unconditional liquidity available to the firm. In particular, I examine the importance of covenants and how covenant violations affect the availability of the line of credit. Third, I explore the interaction between lines of credit and the literature on "financial constraints" and cash holdings. The ability to obtain a bank line of credit is a potentially important component of reducing "financial constraints," but has not been examined in the literature on cash holdings in liquidity management. While the majority of the paper focuses on these 3 issues, I also provide novel results on general correlations in the data. Given the lack of previous empirical research in

the area, these new statistics should improve the understanding of this important source of corporate finance.

In the first set of results, I examine the role of lines of credit versus cash in corporate liquidity management. Such an examination is a natural starting point given the similarities in the theoretical literature on bank lines of credit and cash holdings. Models in the theoretical literature suggest that bank lines of credit are motivated primarily by capital market frictions in future credit markets (Boot, Thakor, and Udell, 1987; Holmstrom and Tirole, 1998). A committed line of credit overcomes these frictions by ensuring that funds are available for valuable projects. A parallel body of research emphasizes the importance of cash holdings in corporate liquidity management (Almeida, Campello, and Weisbach, 2004; Faulkender and Wang, 2005; Opler, Pinkowitz, Stulz, and Williamson, 1999). This body of research works under a similar assumption: cash serves an important liquidity role given that capital market frictions prevent firms from obtaining external sources of finance for valuable projects arising in the future. Despite similar assumptions regarding capital market imperfections, the literature on bank lines of credit and cash do not interact. This lack of interaction leads to a key question: what governs the choice between bank lines of credit and cash in corporate liquidity management?

My findings suggest that bank lines of credit are a viable liquidity alternative to cash only for firms with a historical track record of positive operating performance. More specifically, the supply of lines of credit by banks is particularly sensitive to the firm's profitability; only firms with high profitability are able to obtain and maintain lines of credit. The cross section coefficient estimates imply that a one standard deviation increase in profitability at the firm increases the used and unused portion of lines of credit by 20 to 25 percent. This result is not generally true of all debt instruments. I show evidence that the use of other types of debt, such as term bank debt or arm's length debt, does not show a strong positive correlation with firm profitability.

I interpret this finding as evidence that the supply of lines of credit by banks is particularly sensitive to firm profitability. I provide support for this interpretation by using the *bank liquidity to total liquidity ratio*. This ratio is defined as the amount of unused lines of credit available to the firm divided

by the sum of cash holdings and unused lines of credit. It represents the proportion of total liquidity available to the firm that is provided by external sources. Consistent with the supply interpretation, I confirm that the bank liquidity to total liquidity ratio is positively related to the historical profitability of the borrower. In other words, borrowers with high profitability are able to obtain bank lines of credit for liquidity management, whereas firms with low profitability are forced to rely on internal cash. This relationship holds both in the cross-section and within a given firm over time. The fixed effects estimate implies that a one standard deviation decrease in lagged profitability for a given firm decreases the bank liquidity to total liquidity ratio at the firm by 10 percent at the mean.

In the second set of results, I explore the degree to which bank lines of credit provide unconditional liquidity to the firm. Consistent with the prior result, I find that, even among the more profitable firms that obtain a line of credit, banks condition the availability of the line on the maintenance of profitability. More specifically, I find that availability under lines of credit is contingent on numerous financial covenants, of which the maintenance of profitability is the most common. I also find evidence that covenants on lines of credit are "most" binding; the propensity of firms to violate financial covenants on lines of credit is 2 to 3 times higher than the propensity to violate covenants on any other debt instrument. Only profitable firms are able to obtain lines of credit, and only firms that remain profitable are able to avoid covenant defaults.

I further explore covenant violations, and I document that a drop in profitability leads to "technical defaults," or violations of these covenants by borrowing firms. I find that such violations are in turn associated with a restriction of the unused portion of the line of credit. In particular, a one standard deviation decrease in profitability increases the probability of technical default by 0.11 (on a mean of 0.11). In turn, a technical default for a given firm one year ago is associated with a reduced unused line of credit capacity of more than 30 percent at the mean. While banks appear to reduce availability in response to a covenant default, the reduction is temporary. By the second year after the default, the amount available under the line of credit returns to the pre-default level.

There are three important implications of this finding. First, this finding quantifies the degree to which a line of credit provides *unconditional* liquidity to the firm. A common prediction in the theoretical literature is that lines of credit represent debt financing that is more committed than alternative spot market debt instruments. I find that covenant defaults lead to a restriction of the unused portion of the line of credit; however, borrowers still have access to a smaller line of credit, and regain full access to the line 2 years after default. Second, this finding supports models in which covenants play an important role in facilitating bank monitoring (Rajan and Winton, 1995; Park, 2000). The empirical evidence suggests that banks use covenant defaults to temporarily reduce credit exposure and re-evaluate the lending position. Third, this finding implies that bank lines of credit are not a perfect liquidity substitute for cash in all future states. Lines of credit are a perfect substitute for cash in corporate liquidity management only when firms expect to maintain positive operating performance.

The first two results explain why bank lines of credit are not a perfect liquidity substitute for cash for firms with low profitability or those experiencing drops in performance. In the third set of results, I examine the "financial constraints" and cash literature more directly, and I link my findings with those of Almeida, Campello, and Weisbach (2004). They develop a model with an important insight: firms that are likely to face constraints in obtaining future financing save cash out of cash flow. In their empirical analysis, they use measures of "financial constraints" that are widely used in the literature: the payout ratio of the firm, the size of the firm, and whether the firm has a public debt or commercial paper rating. In my results, I use access to a line of credit as a potential measure of financial constraints. Theoretical research suggests that bank lines of credit should resolve future financial constraints; the examination of cash flow sensitivities of cash for firms with and without lines of credit is a natural extension of their analysis. The results suggest that firms without access to a line of credit save more cash out of cash flow than firms with access to a line of credit, which is consistent with their framework. In addition, among firms that are financially-constrained by *their* definitions, the firms *without* access to a line of credit have a higher cash flow sensitivity of cash than firms *with* access to a line of credit. For example, firms with low payout ratios have a higher cash flow sensitivity of cash, *but* firms with low payout ratios *and* access

to a line of credit do not have a higher cash flow sensitivity of cash. Overall, my results suggest that the measures of financial constraints used in the previous literature, while correct on average, omit important information on lines of credit that may add explanatory power.

In addition to these three results, this paper is the first, to my knowledge, to document several interesting facts regarding the use of bank lines of credit by corporations. As mentioned above, bank lines of credit are the most widely used source of debt financing among public firms. Over 80 percent of firms in my sample obtained a bank line of credit between 1996 and 2003, which is more than twice the percent that obtained any other form of debt. I also find that lines of credit are utilized among firms that are completely equity financed; 30 percent of firm-year observations where no outstanding debt is recorded on the balance sheet have an available unused line of credit. In addition, firms that use arm's length debt do not cease using bank lines of credit; 96 percent of firm-year observations that have arm's length debt also have a bank line of credit.

Finally, this paper makes an important data methodology contribution by documenting biases in the *Dealscan* database by the Loan Pricing Corporation. In the banking and corporate finance literature, *Dealscan* is one of the most commonly used data sources to track banking relationships and lending activities for public firms. By comparing the firms that have bank debt recorded on the annual 10-K SEC filing with *Dealscan*, I show evidence that *Dealscan* systematically misses loans to smaller and younger public firms. This evidence suggests caution in using *Dealscan* to measure the presence of bank loans and lending relationships.

There are three empirical papers on lines of credit that are directly related to the research presented here. Ham and Melnik (1987) collect data from a direct survey of 90 corporate treasurers. They find that draw downs on lines of credit are inversely related to interest rate cost and positively related to total sales. Agarwal, Chomsisengphet, and Driscoll (2004) examine the use of lines of credit for 712 privately-held firms that obtained loans from FleetBoston Financial Corporation. They also find that firms with higher profitability obtain larger credit lines, which is consistent with evidence presented here. Berger and Udell (1995) use data on lines of credit extended to small private businesses and show

that firms with longer banking relationships pay lower interest rates and are less likely to pledge collateral. Shockley and Thakor (1997) and Kashyap, Rajan, and Stein (2002) focus on contract structure of credit lines and the types of financial institutions that provide them. Gatev and Strahan (2005) use aggregate data on loans and commercial paper to show that lines of credit are drawn when commercial paper markets experience negative supply shocks. This paper is the first, to my knowledge, to systematically analyze balances of used and unused bank lines of credit at public corporations. Kaplan and Zingales (1997) and Houston and James (1996) present data on unused lines of credit, but do not explore the relationship between lines of credit and firm characteristics.

In the next section, I describe lines of credit, the data, and summary statistics. In Section II, I describe the theoretical framework that motivates the paper. Sections III through V present the empirical analysis, and Section VI concludes.

I. Lines of credit: description, data and summary statistics

A. Description

A firm that obtains a line of credit receives a nominal amount of debt capacity against which the firm draws funds. Lines of credit, also referred to as revolving credit facilities or loan commitments, are almost always provided by banks or financing companies. In the sample I describe below, 95 percent of the lines of credit described in annual 10-K SEC filings are explicitly listed as being from banks or financing companies. The used portion of the line of credit is a debt obligation, whereas the unused portion of the line of credit remains off the balance sheet. In terms of pricing, the firm pays a commitment fee on the unused portion of the line of credit that is a percentage of the unused portion, and a pre-determined interest rate on any drawn amounts. Pricing data are not available directly from annual 10-K SEC filings; in a sample of 19,523 lines of credit obtained between 1996 and 2003 in the Dealscan data base by the Loan Pricing Corporation, the average commitment fee is 33 basis points, and the average interest rate on drawn funds is 195 basis points above LIBOR.

Existing lines of credit are detailed on annual 10-K SEC filings by corporations. For example, Lexent Inc., a broadband technology company, details their line of credit in their FY 2000 10-K filing as follows:

> At December 31, 2000, the Company had notes payable to banks aggregating $2.0 million under a $50 million collateralized revolving credit facility, which expires in November 2003. Borrowings bear interest at the prime rate or at a rate based on LIBOR, at the option of the Company. This credit facility is to be used for general corporate purposes including working capital. As of December 31, 2000, the prime rate was 9.5%.

In the 10-K filing, companies typically detail the existence of a line of credit and its availability in the liquidity and capital resources section under the management discussion, or in the financial footnotes explaining debt obligations.

B. Data

The existing empirical research on lines of credit is limited partially due to the lack of data. I attempt to bridge this gap by collecting data directly from annual 10-K SEC filings of corporations. The most commonly used database for financial characteristics of public corporations is Compustat. Although Compustat contains valuable information regarding the debt structure of firms, it does not contain sufficient detail for my analysis. More specifically, using Compustat alone, it is not possible to determine whether debt comes from public issues, banks, private placements, shareholders, or from non-bank private sources. In addition, there is no record on the existence of unused bank lines of credit. These data are available, however, in the debt schedules of annual 10-K SEC filings. As Johnson (1997) notes, Regulation S-X of the U.S. Securities and Exchange Commission requires that firms identify the sources of long-term debt.[1] For example, the firm almost always reports the amount of a given debt issue or loan, if it is public or private, the source of the debt, and whether the debt obligation is from a bank or other institution. In addition, Regulation S-K of the U.S. Securities and Exchange Commission requires firms to discuss explicitly their liquidity, capital resources, and result of operations (Kaplan and Zingales,

[1] Although corporations are only required to report the details of long-term debt, almost all corporations also provide information on their short-term debt.

1997). All firms filing with the SEC therefore provide detailed information on the used and unused portions of bank lines of credit.

This paper is not the first to collect data on the sources of debt from annual 10-K SEC filings. Johnson (1997) collects these data for a cross-section of 847 firms in 1989. In two papers, Houston and James (1996, 2001) use a sample of 250 firms for which they collect these data in years 1980, 1985, and 1990. Cantillo and Wright (2000) collect data for 291 firms, which they follow from 1974 through 1992. Asquith, Gertner, and Scharfstein (1994) collect these data for a sample of 102 financially-distressed junk bond issuers which they follow during the late 1980s and early 1990s. In the data appendix, I directly compare the data that I collect to that of Houston and James (1996).

The data set begins with 7,723 non-financial, U.S.-based, independent Compustat firms with non-missing, strictly positive asset data between 1996 and 2003. I then form a sampling universe; it contains firms with at least 4 consecutive years of positive data on total assets (*item 6*), and 4 consecutive years of non-missing data on total liabilities (*item 181*), total sales (*item 12*), operating income before depreciation (*item 13*), share price (*item 199*), shares outstanding (*item 25*), preferred stock (*item 10)*, deferred taxes (*item 35*), and convertible debt *(item 79*). These data limitations are governed by the necessity of these variables in constructing basic characteristics of the firm. I also require firms to have 4 consecutive years of book leverage ratios between 0 and 1.

I focus on the 1996 to 2003 period because annual 10-K SEC filings are available electronically for all firms in the years after 1995, which makes the costs of data collection much lower for this time period. I restrict the sample to firms with at least 4 consecutive years of data because I am particularly interested in how line of credit use evolves for a given firm over time. The universe of Compustat firms that meet these criteria includes 4,681 firms. I then randomly sample 300 firms from this universe, and follow them from 1996 through 2003, for a total unbalanced panel of 2,180 firm-year observations. The random sample employed in this paper represents 6.4 percent of the firms in the sampling universe.

The random sample begins with an unbalanced panel of 300 firms and 2,180 firm-year observations. For these 300 firms, I collect detailed data on the sources of debt and used and unused lines

of credit from annual 10-K SEC filings. Firms filing their initial 10-K with the SEC typically include up to 2 years of historical data in their initial 10-K. Although these historical data generate Compustat observations with non-missing information on earnings and assets, the actual 10-Ks for these firm-year observations do not exist. I include only firm-year observations where an actual 10-K exists. I drop 91 firm-year observations due to this restriction. I also drop 67 observations where book leverage is greater than 1. Finally, I drop 106 firm-year observations where share price (*item 199*), tangible assets (*item 8*), or EBITDA (*item 13*) is missing. The final sample includes 300 firms and 1,916 firm-year observations.

Core financial variables are calculated from Compustat and are defined as follows. Book debt is short term debt plus long term debt (*item 34 + item 9*), all divided by total assets (*item 6*). Balance sheet cash is measured using *item 1*. A measure of asset tangibility is defined as tangible assets (*item 8*) divided by total assets. The market to book ratio is defined as total assets less the book value of equity plus the market value of equity, all divided by total assets. The book value of equity is defined as the book value of assets (*item 6*) less the book value of total liabilities (*item 181*) and preferred stock (*item 10*) plus deferred taxes (*item 35*). The market value of equity is defined as common shares outstanding (*item 25*) multiplied by share price (*item 199*). Finally, the primary measure of profitability is EBITDA (*item 13*), divided by total assets. In the majority of the data analysis, I use the 3-year lagged average EBITDA to total assets ratio as the primary measure of profitability.[2] In order to reduce the influence of outliers, I follow the literature and Winsorize the market to book ratio and profitability at the 1st and 99th percentile.

I summarize here the categorization of different types of debt from annual 10-K SEC filings; a more detailed analysis is in the data appendix. The data collected on lines of credit and debt structure come from two places on the annual 10-K SEC filing: the "Liquidity and Capital Resources" section in the "Management Discussion," and the financial footnotes that address debt. I categorize the types of debt into 6 groups. The first broad category is bank debt. Bank debt includes debt held by commercial

[2] Compustat items 13 and 6 are available for the previous 3 years for 1,838 of the 1,916 firm-year observations, and for the previous 2 years for 1,914 firm-year observations. When not available for the previous 3 years, I use whichever of the 3 years are available to construct the average.

banks, financing companies, credit corporations, and unspecified "financial institutions." Bank debt is split into draw-downs on lines of credit and term loans, and I also collect data on unused lines of credit. If a line of credit backs up a commercial paper program, any outstanding commercial paper is subtracted from the line of credit. Any balance of the back-up line of credit that does not support outstanding commercial paper is recorded as unused line of credit. This is consistent with the actual reporting done by firms. It is important to note that borrowers with a commercial paper back up line of credit often utilize the portion of the line that does not back up outstanding commercial paper. As I show below, only 5 percent of firms in my sample have a commercial paper program, and all results are robust to the complete exclusion of these firms.

The annual 10-K SEC filings of 95 percent of firm-year observations with any type of line of credit explicitly state that the line of credit is from a commercial bank or financing company. Approximately 4 percent do not list the source of the line of credit, and 1 percent state that the line of credit is from an affiliated non-financial business. I include the former as bank lines of credit, whereas the latter is considered private non-bank debt. It is important to note that I do not distinguish lines of credit provided by commercial banks primarily funded with deposits and lines of credit provided by financing companies primarily funded with commercial paper or equity.[3] This is due to a data limitation; the language in the annual 10-K SEC filings usually refers to financing companies as "banks" and often simply states that the line of credit is from a "financial institution."

The second broad category of debt is arm's length debt, which includes public debt, most private placements, industrial revenue bonds, and commercial paper. Private placements that are held by 2 or fewer institutions are excluded from this category. The third, fourth, and fifth broad categories of debt are convertible debt, non-bank private debt, and capitalized leases. Non-bank private debt includes debt to related parties, shareholders, customers, vendors, insurance companies, private placements held by 2 or

[3] Kashyap, Rajan, and Stein (2002) and Carey, Post, and Sharpe (1998) provide theoretical and empirical results that commercial banks and financing companies are distinct in their propensity to provide lines of credit and in their general lending behavior. Unfortunately, these data do not allow me to evaluate these findings.

fewer institutions, and most promissory notes associated with acquisitions. The sixth category of debt includes mortgage debt, debt to state or municipal governments, and debt that is unclassifiable.

There is an increasing body of research that uses *Dealscan* by the Loan Pricing Corporation to track bank loans and lines of credit extended to public firms. There are several disadvantages in collecting information from *Dealscan* compared to collecting data from annual 10-K SEC filings. First, *Dealscan* collects information on loans at origination, not loans available to the firm at a given point in time. This leads to two problems. First, loan terms such as interest rates, amounts, and maturities are frequently renegotiated, and may be quite different even 2 or 3 months after the origination contract. Often, a line of credit is eliminated before the maturity date on the original contract. As a related problem, using *Dealscan* alone, one cannot determine when one loan ends and another begins. For example, company *A* may have a line of credit in *Dealscan* signed at date *t* and at date *t+1*. One cannot determine whether the loan signed at *t+1* is a renegotiated replacement of the loan signed at date *t* (which is common) or an additional and independent loan. This makes tracking the total amount lent to the firm problematic.

Finally, *Dealscan* systematically omits loans from smaller, younger, and more informational opaque public borrowers. There are 261 firms in my sample that have a bank loan or line of credit reported on their annual 10-K SEC filing at some point from 1996 through 2003. I am unable to match 59 of these 261 firms to the *Dealscan* data (23 percent). The firms that I am unable to match are smaller (average assets of $180 million versus $2.6 billion), younger (13 years since IPO versus 16 years since IPO), and more likely to have equity traded only over-the-counter (18 percent versus 10 percent). The differences in the average characteristics are statistically distinct from 0 at the 1 percent level. It is important to emphasize that the *Dealscan* bias exists even among public firms. The true bias in *Dealscan* is likely worse than the bias I report, given that I do not attempt to match all loans by all firms. In other words, 23 percent of public firms in my sample with lines of credit or term bank loans *never* appear in the *Dealscan* database. It is likely that a larger fraction of total loans reported in annual 10-K SEC filings do not appear in *Dealscan*.

C. Summary statistics

[TABLE 1]

Table 1 contains the summary statistics for the sample of 300 firms from 1996 to 2003, for a total unbalanced panel of 1,916 firm-year observations. Bank lines of credit are on average more than 15 percent of book assets, with the used portion being 5.6 percent and the unused portion 9.8 percent. The average *bank liquidity to total liquidity ratio*, which is the ratio of unused lines of credit to unused lines of credit plus balance sheet cash, is 0.44. Despite the fact that unused lines of credit represent almost half of the overall liquidity available to firms, the availability of lines of credit generally has not been recognized in the existing research on the importance of cash in providing liquidity to firms. The average book debt to total assets ratio is 0.21 in the sample, and I use the data collected from annual 10-K SEC filings of firms to break down the debt into various categories. Term bank debt represents 3.4 percent of assets. Arm's length debt accounts for 6.1 percent of total assets, or almost 30 percent of total book debt. Convertible debt accounts for about 1.9 percent of total assets, and non-bank private debt accounts for 1.6 percent of total assets.

In column (3) of Table 1, I present the mean fraction of all firm-year observations where the type of debt obligation in question is greater than 0. About 81 percent of firm-year observations have some type of debt. Almost 71 percent of firm-year observations have positive unused lines of credit, and 48 percent have used lines of credit. Overall, 74 percent of firm-year observations have some unused or used line of credit, and 82 percent of firms in the sample have a line of credit some time between 1996 and 2003; these numbers are higher than the numbers for any other type of debt instrument. Term bank debt is used by 33 percent of firm-year observations, whereas public debt and commercial paper are used by only 14 percent and 5 percent respectively. These statistics confirm a basic fact that is becoming more recognized in recent literature: the majority of public firms do not use public sources of debt (see, for example, Faulkender and Petersen, 2005).

[TABLE 2]

Table 1 shows that 74 percent of firm-year observations in a random sample of Compustat firms have a bank line of credit. Table 2 presents cross-utilization rates to emphasize this broad use of lines of credit. Each column in Table 2 represents a conditional sample, where the sample has the type of debt listed at the top of the column. The rows display what other types of debt firms have conditional on having the type of debt in the column. The first row of the table shows that 88 percent of firm-year observations with term bank debt also have a bank line of credit, and 96 percent of firm-year observations with public debt also have a bank line of credit. Even among firm-year observations with no outstanding debt, 30 percent have an unused line of credit.

II. Motivation for the empirical analysis

In this section, I motivate the empirical analysis of bank lines of credit by discussing the existing theoretical research in two areas: the literature on bank lines of credit and the literature on cash holdings in corporate liquidity management. More specifically, I focus on how an empirical analysis of lines of credit can help resolve unanswered questions in both of these areas.

A. Bank lines of credit

Theoretical research on bank lines of credit follows the optimal contracting literature; it attempts to describe reasons that corporations demand lines of credit relative to other forms of debt.[4] The first class of models uses problems of time inconsistency between borrowers and future creditors to motivate corporate demand for lines of credit. These papers include Berkovitch and Greenbaum (1991); Boot, Thakor, and Udell (1987); Duan and Yoon (1993); Holmstrom and Tirole (1998); Morgan (1994); and Shockley (1995).

I focus here on two of these papers that I believe demonstrate the core intuition of these models. The paper by Holmstrom and Tirole (1998) motivates the use of lines of credit by embedding a moral

[4] There is also research on the supply of bank lines of credit. Boot, Greenbaum, and Thakor (1993) discuss why discretion can be optimal in financial contracting. Their model can be interpreted as support for why banks maintain a level of discretion in deciding whether or not to allow a borrower to draw down on a line of credit. Kashyap, Rajan, and Stein (2002) focus on the supply of lines of credit by banks, but do not explore how borrower characteristics influence the willingness to supply.

hazard problem within a three-period model where a liquidity shock is realized in the second period. When the liquidity shock is realized in the second period, the borrower must retain a large enough portion of the third period return to motivate her to be diligent; in other words, there a standard moral hazard problem that forces the borrower to retain a large stake in the project. Given this agency problem, the first best is unattainable. If the liquidity shock is large enough, the borrower will not be able to obtain funds even if the project has positive NPV, given that she must retain enough of the project return to maintain diligence. In the second best solution, the borrower buys liquidity insurance. One mechanism is a line of credit.[5] In the first period, creditors provide a commitment to lend in the second period up to a certain point. When the liquidity shock is realized, the borrower has access to committed funds. In some states of the world, the creditors end up losing money in the second period, but they break even in expectation. This is the intuition of the liquidity insurance in the model.

Boot, Thakor, and Udell (1987) also use a basic agency problem to motivate corporate demand for lines of credit. They employ a three-period model with an agency problem, where borrowers select an effort level in the first period and choose whether to invest or not in the second period. The moral hazard problem arises because the effort decision is unobservable to creditors. In the Boot, Thakor, and Udell (1987) model, there is stochastic interest rate realized in the second period that serves a similar role as the liquidity shock in Holmstrom and Tirole (1998). If interest rates are too high in the second period, borrowers anticipate a low expected return from the project and thus choose low effort. In other words, high interest rates in the second period lower the return to effort, which leads managers at borrowing firms to shirk. In the second period, banks fully predict such behavior, and thus ration credit. A line of credit signed in the first period solves this problem by charging an up-front fee and guaranteeing a low

[5] Holmstrom and Tirole (1998) emphasize that the line of credit must be irrevocable, and that the liquidity shock is verifiable. In other words, there is no possibility that borrowers misallocate the funds available under the line of credit. In addition, Holmstrom and Tirole (1998) emphasize that other types of financing arrangements may serve the purpose of a bank line of credit in their model, as long as the arrangement provides unconditional financing.

rate of interest in the second period. Thus, the line of credit serves as interest rate protection which can guarantee that borrowers put in high effort initially.

There are three main empirical implications of these models. First, the models assume that basic agency problems due to information asymmetry motivate corporate demand for lines of credit. In other words, firms where management actions are less transparent are more likely to use lines of credit. Second, a bank line of credit must provide some degree of "commitment" if it is to improve on spot market financing. If banks can fully renegotiate the line of credit in the interim period, the contract will not improve on spot-market financing. In the models described above, the optimal behavior for the bank in some states of the interim period is to restrict access to the line of credit. The empirical section of this paper attempts to quantify the extent to which lines of credit represent unconditional obligations of banks.

The third main empirical hypothesis that comes from these models is that it can be difficult for firms to raise capital in spot markets when investment opportunities arrive or change. Lines of credit provide a particularly flexible source of debt financing that can be drawn upon with fewer difficulties.

Martin and Santomero (1997) provide a different approach to motivate corporate demand for lines of credit. They begin with the assumption that firms desire speed and secrecy in pursuing investment opportunities. The value of arriving investment opportunities decays rapidly, and spot market financing requires more time than the use of a line of credit. The first empirical prediction is that firms in high growth industries more heavily utilize lines of credit. The second empirical prediction is similar to the third prediction of the models discussed above; firms use lines of credit because of their speed and flexibility, and lines of credit should therefore be demanded by firms with high business variability.

B. Cash and corporate liquidity

Almeida, Campello, and Weisbach (2004), henceforth ACW, argue that cash holdings represent a safeguard against the inability to obtain financing when valuable opportunities arise in the future. They build a three period model, in which investment opportunities arrive in the first and second periods. Firms are either financially constrained or unconstrained; firms fall into one of these categories based on the level of cash flows and the value of collateral that the firm can pledge to creditors. In the initial

period, unconstrained firms have no reason to save cash out of initial cash flows; they can reduce dividends or raise more external finance in the second period to pursue investment opportunities. Constrained firms, on the other hand, retain a portion of their first-period cash flows to "hedge" against the inability to raise external financing in the second period. The optimal level of saving out of cash flow weighs the cost of reducing investment in the first period with the benefit of more investment in the second period. Constrained firms should therefore save a higher proportion of their initial cash flows relative to unconstrained firms.

Empirical support for this framework is found in ACW (2004); Faulkender and Wang (2005) (henceforth, FW); and Opler, Pinkowitz, Stulz, and Williamson (1999) (henceforth OPSW). ACW (2004) sort their sample based on observable measures of financial constraints (payouts, size, and the existence of third-party credit ratings), and find that more constrained firms save more cash out of cash flow. FW (2005) find that shareholders place higher value on an additional dollar of cash within financially constrained firms, where the measures of financial constraints used are similar to those in ACW (2004). OPSW (1999) find that larger firms and those with credit ratings hold less cash.

While the theoretical and empirical results of the literature on cash and corporate liquidity management are instructive, there are two shortcomings which I directly address in this paper. First, what is the role of bank lines of credit? As mentioned above, the existing theoretical research on bank lines of credit posits that this financial product is designed precisely to solve financial frictions as described in the model of ACW (2004). Firms that face a potential inability to raise future financing obtain lines of credit as a hedging device. Neither the empirical nor theoretical research on cash and corporate liquidity addresses the role of bank lines of credit in reducing the need for firms to use cash. As a related shortcoming, the empirical literature on cash and corporate liquidity does not provide direct insight into the precise "financing" constraint that prevents firms from accessing external funds. The theoretical frameworks of ACW (2004) and FW (2005) rely only on a non-specific "limitation in [the] capacity to raise external finance" (ACW, p 1781). They do not take an empirical stand on what the limitation is.

These two shortcomings together are a primary motivation of this paper. In the spirit of the theoretical literature on bank lines of credit, the empirical analysis of this paper focuses on bank lines of credit as an important financial instrument used in corporate liquidity management. I examine the distribution of bank lines of credit among firms to explore whether they are a substitute for cash in corporate liquidity management. The empirical analysis seeks to identify a specific constraint (the inability to obtain a bank line of credit) that leads firms to hold higher balances of cash and save cash out of cash flows.

III. Lines of credit and firm characteristics

The empirical analysis of the theoretical hypotheses described above is based on a series of linear regressions in which a measure of lines of credit is regressed on firm characteristics. The general specification in Tables 3 and 4 follows:

$$Lines_{it} = \alpha_t + \beta X_{i,t-1} + \alpha_i + \varepsilon_{it} \qquad (1)$$

The dependent variable is a measure of lines of credit scaled by total assets, total debt, or total liquidity. The matrix *X* contains variables that are motivated by existing theoretical research. First, the existing theoretical research hypothesizes that firms with a greater degree of information asymmetry have a stronger demand for lines of credit. I construct measures of information asymmetry that are consistent with measures in Faulkender and Petersen (2005) and Sufi (2005). Firms with equity that is not traded on a major exchange receive less analyst coverage and media attention. Likewise, firms that are not in one of the three main S&P indices (the S&P 500, the S&P Midcap 400, and the S&P Smallcap 600) also receive less attention. I use an indicator variable for whether the firm's equity trades only over the counter and I use an indicator for whether the firm is NOT included in one of the main S&P indices to measure information asymmetry. Older firms are also more likely to be known to capital markets. I include the natural logarithm of 1 + the years since the firm's IPO as an additional measure of information asymmetry. The year of the firm's IPO is approximated using the first year in Compustat that the firm's share price is available.

Second, more profitable firms should be able to obtain external financing more easily through a supply effect; banks should be willing to extend larger lines of credit to more profitable firms. To measure the supply elasticity of lines of credit with respect to firm profitability, I include a profitability measure as an independent variable. I measure firm profitability for firm *i* in year *t* by averaging firm *i*'s EBITDA to total assets ratio for years *t-3* to *t-1*. In the remainder of the text, I refer to this measure as *firm profitability*. I use this measure for two reasons: first, it represents a historical "reputation" of the borrower and serves as a measure of the probability that the firm enters into distress. Second, as I show below, banks rely on measures of profitability more heavily than any other measure when establishing covenants on lines of credit.

The third set of variables attempts to capture the degree to which firms demand flexibility in their financing options. The theoretical literature suggests that lines of credit are a particularly flexible source of debt financing, and predicts that firms with a desire for flexibility should more heavily utilize bank lines of credit. I use three variables to measure the demand for flexibility. First, I include the median within-year standard deviation of sales for all firms in the given firm's 3-digit SIC code industry.[6] I refer to this variable as *seasonality*. Firms in 3-digit industries that show a larger degree of seasonality in sales may desire lines of credit to manage cash flows and inventory. I also include a measure of the variability of profits, which is based on the measure used in Mackie-Mason (1990). It represents the standard deviation of annual changes in the level of EBITDA over a lagged 4 year period, scaled by average total assets in the lagged period. Finally, I follow Rajan and Zingales (1995) and use the lagged market to book ratio as a measure of investment opportunities. A higher market to book ratio measures more quickly arriving investment opportunities.

[6] This variable is constructed as follows: I use the entire set of firms with data available in the Compustat quarterly industrial files. For every firm-year, I calculate the standard deviation of the quarterly differences in sales, scaled by average assets over the year. I then obtain the median across all 3-digit SIC industries, for every given year. This variable is then merged onto each firm-year observation with the same 3-digit SIC code. This measure is similar to the earnings variance measure used in Mackie-Mason (1990).

The matrix *X* also contains as additional controls the tangible assets to total assets ratio and the natural logarithm of total sales (Rajan and Zingales, 1995). In addition, all regressions include year indicator variables and 1-digit SIC industry indicator variables. The estimation in equation (1) is carried out using both pooled OLS and fixed effects regressions.[7] In all specifications, standard errors are adjusted for the correlation of unobservable errors across years for the same firm.

A. Lines of credit scaled by assets and total debt

[TABLE 3]

In columns (1) through (3) of Table 3, I present coefficient estimates from specifications where the dependent variables are measures of lines of credit scaled by total assets. In order to provide a benchmark against which these results should be viewed, I also present coefficients using the other two largest sources of debt: term bank debt (column (4)) and arm's length debt (column (5)). The effect of firm profitability on the use of lines of credit is strong. The estimate in column (1), which is statistically distinct from 0 at the 1 percent level with a *t*-statistic of 4, suggests that a one standard deviation increase in profitability increases the total line of credit to assets ratio by (0.21*0.15=) 0.03, which is 22 percent at the mean of the dependent variable. The coefficient estimates in columns (2) and (3) are positive and statistically distinct from 0 for both used and unused lines of credit. In terms of magnitudes, the estimates imply that a one standard deviation increase in firm profitability increases the used and unused line of credit to total assets ratio by 20 percent and 21 percent at their respective means.

One worry is that this result is trivial: any lender is worried about potential default which is negatively correlated with firm profitability, and thus supply should be quite elastic with respect to profitability. In other words, firms with low profitability may have no debt capacity, which may explain why they are unable to obtain lines of credit. In columns (4) through (7), I provide evidence that the magnitude of the supply effect is particularly strong with bank lines of credit relative to other forms of

[7] Between, or firm-means, estimation produces coefficient estimates and levels of significance that are very similar to the pooled OLS regressions. Given that the dependent variables have a minimum value of 0, I also use maximum likelihood tobit estimation which yields very similar results (unreported).

debt. While the point estimate of the effect of profitability on the use of term bank debt is positive in column (4), it is lower in magnitude and not statistically distinct from 0 at a reasonable confidence level. In column (5), the estimated coefficient on firm profitability implies that more profitable firms use less arm's length debt. An alternative method for showing the same result is to see how firm profitability affects the proportion of total debt that is in the form of lines of credit. In columns (6) and (7), I isolate the sample to firms where total debt is at least 5 percent of total assets, and I scale used and unused lines of credit by total debt. The coefficient estimate on profitability in columns (6) and (7) implies that a one standard deviation increase in firm profitability leads to a 29 and 32 percent increase in the used and unused line of credit to total debt ratio at the means of the left hand side variables, respectively.

[FIGURE 1]

Figure 1 offers further evidence on the unique effect of firm profitability on the supply of lines of credit. It plots the residuals from a regression relating various types of debt to all firm characteristics except firm profitability. In other words, it plots the variation in the types of debt across the profitability distribution after partialling out all firm characteristics except for profitability. Figure 1 shows the strong positive relationship between lines of credit and firm profitability.[8] Line of credit debt is the only type of debt that shows a systematic positive correlation with firm profitability. Arm's length debt and private and convertible debt show a negative relationship with firm profitability. Term bank debt has no discernable pattern. The graph supports the unique effect of firm profitability on the supply of lines of credit; firms with low profitability are able to raise alternative sources of debt, but appear unable to obtain bank lines of credit.

These results suggest that the supply elasticity of lines of credit with respect to profitability is particularly high. There are two caveats. First, I do not want to interpret the negative effect of profitability on arm's length debt as evidence that supply in these markets is a decreasing function of

[8] The point estimate on firm profitability in column (1) of Table 3 represents the average linear effect of profitability on the supply of lines of credit, whereas Figure 1 shows the entire distribution, rather than just the average linear effect.

profitability. There are likely demand-related reasons (such as debt overhang) that firms with higher profitability prefer not to have high balances of arm's length debt. Second, the negative effect of profitability on arm's length debt may be due to a legacy effect; firms that were profitable when they issued longer maturity arm's length debt subsequently experience drops in profitability while the debt is still outstanding. Even with these caveats, the results in Table 3 and Figure 1 suggest that line of credit suppliers rely more heavily on profitability when deciding to extend credit than suppliers of other debt instruments. The discrepancy between the effect of profitability on the availability of term bank debt and lines of credit is particularly suggestive, given that the lenders, maturity, and amounts of these two debt instruments are similar.

In terms of business variability, firms in more seasonal industries hold higher balances of unused lines of credit. However, there is no statistically positive effect of either the earnings variance of the firm or the market to book ratio on the use of lines of credit. In fact, the results suggest that firms with high market to book ratios are less likely to use lines of credit. This effect, however, is not unique to lines of credit relative to other forms of debt. Consistent with Rajan and Zingales (1995), I find that firms with higher market to book ratios use less debt generally. Overall, these results suggest that lines of credit are demanded by firms with seasonal sales patterns; the evidence is consistent with the theoretical hypotheses described above. The results are also consistent with survey evidence described in Avery and Berger (1991); respondents in the survey suggest that flexibility and speed of action are their primary reasons for obtaining lines of credit.

In terms of information asymmetry, the results in columns (1) through (3) imply that younger firms and firms that are NOT in a major S&P index hold higher balances of used and unused lines of credit. The coefficient estimates on firm age are particularly strong in magnitude and statistical significance; they suggest that younger firms use lines of credit more heavily in their financing decisions. While these results appear to support the hypothesis that firms with a greater degree of information asymmetry more heavily use lines of credit, I urge caution given the coefficient estimates in column (4). The effect of information asymmetry on the use of *term* bank debt is also strong and positive, which is

consistent with theoretical and empirical research (Diamond, 1991, Houston and James, 1996). In addition, firm size, which is likely to be a measure of information asymmetry, has a positive effect on the use of bank lines of credit, but a weaker effect on term bank debt. The results in column (5) do not support a *unique* effect of information asymmetry on the use of lines of credit relative to term bank debt.

B. Bank liquidity to total liquidity ratio

In this section, I examine how lines of credit fit into the overall liquidity management strategy of the firm. The key measure I evaluate is the bank liquidity to total liquidity ratio, which is defined as the ratio of unused lines of credit to the sum of unused lines of credit and cash. This ratio describes the extent to which a given firm relies on bank lines of credit in its overall liquidity profile. I evaluate this measure in order to assess why some firms rely heavily on cash in their corporate liquidity management (ACW, 2004; FW, 2005, OPSW, 1999).

[FIGURE 2]

Panel A of Figure 2 displays the relationship between sources of liquidity and profitability. It demonstrates a key finding of the paper: there is an inverse relationship between cash holdings and the availability of lines of credit across the profitability distribution. Firms in the low profitability deciles hold more cash and less bank liquidity, and the relationship reverses as firms become more profitable. Panel B maps the bank liquidity to total liquidity ratio across the profitability distribution; it shows a positive relationship between the proportion of liquidity held in bank lines of credit and the firm's profitability. In addition to showing how liquidity varies over the profitability spectrum, Figure 2 also provides evidence that the results in Table 3 are driven by supply effects. In the absence of pricing effects driven by supply, there are few reasons why more profitable firms *demand* unused lines of credit *relative* to cash, and that low profitability firms *demand* cash relative to unused lines of credit. The fact that low profitability firms hold higher cash balances suggests that they are unable to obtain a line of credit at a reasonable price.

[TABLE 4]

In Table 4, I report coefficient estimates from an empirical specification where I use the bank liquidity to total liquidity ratio as the dependent variable. The results in column (1) show that the trends in Figure 2 are robust to a more rigorous empirical specification. The effect of firm profitability on the bank liquidity to total liquidity ratio is positive and statistically significant. Why do banks restrict access to firms with low profitability? The results in columns (2) through (5) of Table 5 show that banks rely on profitability to a greater degree when firms are more likely to enter financial or economic distress. In regressions reported in columns (2) and (3), I split the sample based on the non-line of credit debt to total assets ratio of the firm. Firms with large balances of debt from other sources are likely to face higher agency problems and distress likelihoods. The results show that the positive effect of firm profitability on the willingness of banks to extend lines of credit is concentrated among firms with high non-line of credit debt to asset ratios. The coefficient estimate in column (2) implies that a one standard deviation increase in profitability among this sub-sample increases the bank liquidity to total liquidity ratio by (0.09*0.57) = 0.05, which is about 10 percent at the mean. The effect of firm profitability among firms with low non-line of credit debt ratios is not statistically distinct from 0 at a reasonable confidence level, and the coefficient estimates in the two samples are distinct from one another at the 1 percent level.[9] In columns (4) and (5), I report similar results when splitting the sample based on Altman's Z Score (1968) measure of the probability of default.[10] When a bank is particularly concerned with a borrower entering distress, it relies more heavily on profitability in its decision to extend credit.

Column (6) presents coefficient estimates from a fixed effects regression of the bank liquidity to total liquidity ratio on 1-period lagged profitability. In other words, these estimates answer the following question: when a *given* firm experiences a drop in profitability relative to its own average profitability, do banks become less willing to supply lines of credit to that firm? The fixed effects specification removes

[9] Throughout this paper, levels of significance that compare coefficient estimates across samples are obtained by grouping all firms into one sample, and estimating a fully interacted model. This produces identical coefficient estimates, and the levels of significance are based on the interaction terms.

[10] I follow Mackie-Mason (1990) and use a measure of the Z Score that excludes the debt-based factor to avoid mechanical endogeneity.

unobservable variation across firms that does not vary across time; it therefore produces an estimate of the effect of firm profitability on the willingness of banks to supply lines of credit that is less subject to unobservable variable bias. The coefficient estimate in column (6) implies that a drop in profitability for a given firm reduces the bank liquidity to total liquidity ratio.

The results in Tables 3 and 4 identify why bank lines of credit may not serve as a substitute for cash for all firms. Firms with low historical profitability are able to obtain less of their liquidity from bank lines of credit, and rely more heavily on cash in their corporate liquidity management. When a given firm experiences a drop in profitability, it loses access to its line of credit and uses cash more heavily in its corporate liquidity management.

IV. How unconditional are lines of credit?

A. Large sample evidence

The results in the previous section suggest that bank lines of credit are not an available source of liquidity for firms with low profitability and a higher probability of financial distress. In this section, I examine the degree to which a line of credit provides unconditional liquidity to the firms that obtain them. In other words, I examine whether lines of credit are a perfectly liquid substitute for cash in all potential future states. The existence of covenants and material adverse change clauses in loan contracts suggests that lines of credit are conditional on firm performance. However, there is little empirical evidence that quantifies the degree to which lines of credit represent committed liquidity.

I focus in particular on the role of financial covenants,[11] or covenants that require the maintenance of financial ratios.[12] Financial ratios are specified in the initial contract, and the borrower is in default of the loan agreement if a ratio is not satisfied. These defaults are referred to as "technical

[11] See the seminal work by Smith and Warner (1979) for a further description of the motivation behind covenants. See Bradley and Roberts (2004) for a more comprehensive view of covenant data available in Dealscan.

[12] The material adverse change clause (MAC) is also an important feature in bank loan agreements. However, I find little evidence from annual 10-K SEC filings that this clause is invoked with frequency.

defaults," and the lender has the legal right to accelerate the loan. While most technical defaults are renegotiated, the terms of the loan can change significantly.

[TABLES 5 & 6]

Table 5 presents evidence from Dealscan by the Loan Pricing Corporation on financial covenants. The sample includes 19,523 sole lender and syndicated lines of credit obtained by non-financial businesses from 1996 to 2003. Almost half of all lines of credit in the sample have covenants based on financial ratios. The most common type of financial covenant is a cash flow or profitability based covenant, occurring on 38 percent of the lines of credit. Covenants on total net worth and balance sheet based covenants are also common. The most common covenant in the Dealscan sample is a debt to cash flow covenant, which is on 24 percent of the lines of credit. Banks rely heavily on firm profitability when placing covenants on the lines of credit they extend to firms; this evidence complements the evidence in the previous section on the importance of firm profitability in the willingness to extend credit.

In Table 5, I display covenant data from Dealscan, and not directly from 10-Ks, because companies are not required to detail the debt covenants present on their loan agreements in their SEC filings. However, the SEC does require firms to report covenant *defaults*. More specifically, "companies that are, or are reasonably likely to be, in breach of such covenants must disclose material information about that breach and analyze the impact on the company if material (SEC, 2003)." Table 6 displays data on technical covenant defaults and missed interest payments collected directly from annual 10-K SEC filings.[13] A technical default on some debt agreement is violated in 9 percent of the firm-year observations in the sample. A covenant default is more likely to occur on a line of credit (8 percent) than any other debt instrument. The frequency of a line of credit default is between 2 and 3 times higher than the next highest instrument. In brackets, I report the fraction of firm-year observations with a default conditional on the firm-year observation having the type of debt in question. Even after accounting for

[13] Unfortunately, companies do not always detail on their 10-K *why* a covenant default occurs. They will often just relay that they have violated a debt covenant, but will often not give a further explanation.

the fact that more firms have bank lines of credit, defaults on bank lines of credit are the most common type of default.

[TABLE 7]

Table 7 explores why line of credit defaults occur. The exact specification is a linear probability fixed effects model, where the left hand side variable is 0 if no default occurs and 1 if default occurs. Formally, I estimate:

$$Default_{it} = \alpha_i + \alpha_t + \beta X_{it} + \varepsilon_{it} \quad (2)$$

In this specification, X_{it} represents a matrix of firm profitability, net worth, and leverage measures. As documented above, these measures are subject to covenants. The vector of coefficient estimates of β examines whether reductions in profitability, reductions in net worth, or increases in leverage lead to technical defaults of covenants associated with lines of credit. The sample for the estimation of (2) includes only firm-years where a line of credit is present, and standard errors are heteroskedasticity-robust, clustered at the firm level.[14]

Column (1) shows that a drop in profitability is associated with a higher probability of default on a covenant. The coefficient estimate implies that a one standard deviation decrease in profitability (0.21) increases the probability of default by (0.21*0.53 =) 0.11 on the mean of the left hand side variable in this sub-sample of 0.11. In column (2), I examine how a fall in net worth and rise in leverage affects the probability of default. The coefficient estimates imply that a one standard deviation drop in net worth to total assets ratio (1.9) increases the probability of default by (1.9*0.019 =) 0.04 and a one standard deviation increase in leverage (0.20) increases the probability of default by (0.20*0.44=) 0.09. Even with the lower coefficient estimate on profitability in column (3), a one standard deviation decrease in profitability still leads to almost a 0.08 increase in the probability of default. In column (3), I separate

[14] I also estimate equation (1) using fixed effects in a maximum likelihood logit specification, and find almost identical results to the linear probability model reported. I report linear probability fixed effects estimates because most specifications in this paper are linear, and I want to remain consistent in interpretations of coefficients as marginal linear changes at the mean.

debt into its three largest components. The coefficient estimate on the used line of credit to total assets ratio implies that draw-downs on lines of credit *mechanically* lead to covenant defaults. In other words, when a firm draws down on its line of credit, it increases its probability of violating a covenant on the line of credit. The results suggest that banks use covenants to protect themselves against increased credit exposure and to facilitate monitoring, which is consistent with theoretical work by Rajan and Winton (1995) and Park (2000).

[FIGURE 3]

What happens to the availability of the line of credit when a firm defaults on its covenants? Figure 3 focuses on 49 firms in the sample that have exactly one covenant default during the sample period, and it maps the total, used, and unused lines of credit to total assets ratios relative to the default year. The data are "default-time scaled" so that *t=0* is the year that the firm defaults on its line of credit covenant. Figure 3 shows that the used portion of the line of credit increases directly before the firm defaults on a covenant. When a firm defaults, there is a subsequent reduction in the availability of the total and unused line of credit at *t+1*. The unconditional means suggest that the bank reduces the availability of the unused line of credit from 0.107 to 0.077, or about 30 percent, when the borrower defaults on the line of credit. Figure 3 also shows that the availability of the line of credit returns to its pre-default level two years after default. The results in Figure 3 suggest that the availability under a line of credit is conditional on the maintenance of covenants; a violation of a covenant leads to a temporary drop of about 30 percent in the availability of the line of credit.

[TABLE 8]

Table 8 reports coefficient estimates from a regression that replicates the findings in Figure 3. More specifically, I estimate:

$$Line_{it} = \alpha_i + \alpha_t + \beta X_{i,t-1} + \gamma * Default_{i,t-1} + \varepsilon_{it} \qquad (3)$$

The sample includes only those firm-year observations where a line of credit was present at *t-1* and where the firm has at most 1 covenant default in the sample. Standard errors are heteroskedasticity-robust,

clustered at the firm level. The results in columns (1) and (2) demonstrate that a default at *t-1* leads to a reduction in the total and unused line of credit of about 0.039, which is 30 percent at the mean of the left hand side variable. In columns (3) and (4), I examine whether the availability of the line of credit returns to its pre-default level two years after default. As the coefficient estimate on the two-period lagged default measure shows, the total and unused line of credit almost completely return to the pre-default level. The regression coefficients on 1-period lagged default and 2-period lagged default are statistically distinct from one another at the 10 percent level. This implies that there is a statistically significant drop in the availability of the line of credit immediately after a covenant default and a statistically significant return to pre-default levels two years after default.

One concern with the latter result is survivorship bias. Assume that default occurs at time *t*, and there is a statistically significant drop in the availability of lines of credit at *t+1*. I assert that there is a statistically significant reversal of the drop *t+2* arrives. An important concern is whether borrowers file for bankruptcy or are liquidated between *t+1* and *t+2*. If many borrowers are forced into bankruptcy or liquidated, then I may overestimate the increase in availability of the line of credit between *t+1* and *t+2*. There are a total of 5 firms (out of 49) that disappear from the sample between *t+1* and *t+2*. I investigate these 5 firms, and I find that 3 were acquired by other firms, 1 filed for bankruptcy, and 1 was liquidated. The small number of firms that filed for bankruptcy or were liquidated suggests that survivorship bias is not responsible for the statistically significant reversal.

The results in Tables 5 through 8 empirically quantify the degree to which lines of credit represent unconditional liquidity available to the firm in all future states. Lines of credit are not totally unconditional obligations of banks; banks use covenant violations to restrict the availability of the line of credit. At the same time, firms, on average, lose access to only 30 percent of the unused line of credit capacity, and they lose access only temporarily. These results suggest that lines of credit represent an improvement over the potential inability to raise spot market financing. They also suggest that a line of credit ceases being a perfectly liquid substitute for cash if a firm experiences a drop in profitability.

B. Anecdotal evidence from 10-Ks

Firms discuss their available bank lines of credit and cash holdings together in the liquidity and capital resources sections of their annual 10-K SEC filings. In this section, I present anecdotal evidence based on quotations from the annual 10-K SEC filings that complement the large-sample statistical evidence presented above.

First, companies often stress the importance of profitability in their ability to maintain compliance with line of credit covenants and avoid default. For example, Pioneer Companies, in their FY 2003 annual 10-K SEC filing, notes with respect to its bank line of credit:

> If the required Lender-Defined EBITDA level under the Revolver is not met and the lender does not waive our non-compliance, we will be in default under the terms of the Revolver. Moreover, if conditions constituting a material adverse change occur, our lender can refuse to make further advances. Following any such refusal, customer receipts would be applied to our borrowings under the Revolver, and we would not have the ability to reborrow *(sic)*. This would cause us to suffer a rapid loss of liquidity, and we would lose the ability to operate on a day-to-day basis.

The language in Pioneer's filing implies that profitability is the key to avoidance of default, and it emphasizes how serious a potential default on the line of credit is to the company. Mace Security makes a similar point in their FY 2002 annual 10-K SEC filing with respect to its bank line of credit arrangements:

> The Company's ongoing ability to comply with its debt covenants under its credit arrangements and refinance its debt depends largely on the achievement of adequate levels of cash flow. Our cash flow has been and can continue to be adversely affected by weather patterns and the economic climate. In the event that non-compliance with the debt covenants should reoccur, the Company would pursue various alternatives to successfully resolve the non-compliance, which might include, among other things, seeking additional debt covenant waivers or amendments, or refinancing of debt with other financial institutions.

Banks often condition the availability of the line of credit on profitability, and a drop in profitability makes the violation of bank covenants more likely. The anecdotal evidence suggests that, even among firms that have access to lines of credit, management understands the pressure to maintain high profitability to allow for additional bank financing. Metretek, Inc. discusses the revolving credit facility of one of its subsidiaries in its FY 2001 filing:

> Our current Credit Facility has a number of financial covenants that Southern Flow must satisfy. Southern Flow's ability to satisfy those covenants depends principally upon its ability to achieve positive operating performance. If Southern Flow is unable to fully satisfy the financial covenants

> of the Credit Facility, it will breach the terms of the Credit Facility … Any breach of these covenants could result in a default under the Credit Facility and an acceleration of payment of all outstanding debt owed, which would materially and adversely affect our business.

This language is very common when management discusses covenants on bank lines of credit in the annual report. At the same time, managers rarely mention any concern with meeting covenants on *non-bank* debt agreements such as private placements or public issues. The anecdotal evidence suggests that binding covenants and prohibitive restrictions are associated with line of credit debt more than any other type of debt instrument.

The coefficient estimates in the previous section show that violations of covenants on lines of credit have a material effect on the availability of unused lines of credit. Anecdotal evidence provides complementary evidence of this fact. With respect to its syndicated line of credit, Total Renal Care Holdings notes in its FY 1999 annual 10-K SEC filing:

> When measured as of December 31, 1999, the company was not in compliance with certain formula-based covenants in the credit facilities. If the lenders do not waive this failure to comply, a majority of the lenders could declare an event of default, which would allow the lenders to accelerate payment of all amounts due under the credit facilities. Additionally, this noncompliance will result in higher interest costs, and the lenders may require additional concessions from the company before giving a waiver … Under these conditions, the company is currently unable to draw additional amounts under the credit facilities.

Bank creditors sometimes terminate the line of credit altogether when covenants are violated. As Tab Products notes in its FY 1999 filings:

> The Company does not currently maintain a line of credit. An unsecured revolving line of credit of $5.0 million was terminated as of June 22, 2000. The Company was out of compliance with two covenants under the line of credit at May 31, 2000.

While I urge caution in interpreting these anecdotes in isolation, I believe they provide complementary evidence when viewed in relation to the large sample statistical evidence presented above. Maintenance of high profitability is a key component to avoiding covenant defaults. In addition, covenant defaults often lead to a restriction in the amount of credit available.

V. Relationship to research on cash holdings

Bank lines of credit are an integral component of corporate liquidity management, yet have not been addressed in the literature on cash holdings and liquidity. In this section, I relate my findings with the empirical findings of ACW (2004). Their important theoretical insight, described above in Section II, is that financially constrained firms are more likely to save cash out of cash flow. They empirically examine their model by sorting firms into financially constrained and unconstrained categories based on four measures: the payout ratio of firms, the size of firms, and whether the firm has a bond rating or commercial paper rating.[15] These "financial constraints" categorizations have become common in empirical corporate finance research. In this section, I use access to lines of credit as a measure of financial constraints: those firms that have access to a line of credit throughout the sample are considered unconstrained and those that do not are considered constrained. Given that theoretical research emphasizes the importance of bank lines of credit in reducing potential financial constraints and providing liquidity, this categorization is a natural extension of ACW (2004).

[TABLE 9]

Table 9 presents the unconditional correlations between the measures of financial constraints used in ACW (2004) and the measure based on access to lines of credit. As the first column demonstrates, the measures are positively correlated. In terms of magnitudes, the bank line of credit access measure is most correlated with the size measure of financial constraints. This is consistent with the evidence in Tables 3 and 4 that larger firms more heavily utilize lines of credit.

[TABLE 10]

Table 10 examines the cash flow sensitivity of cash for various sub-samples based on measures of financial constraints used in ACW (2004). More specifically, the coefficient estimates presented in Table 10 are the outcome of firm fixed effects regressions relating the difference in cash holdings from *t-1* to *t* on cash flow, a measure of investment opportunities (*Q)* and the natural logarithm of total assets, all measured at time *t*. The estimations replicate the estimations that generate results reported in Table III of

[15] For details, see ACW (2004), pages 1789-1790.

ACW (2004). Each coefficient estimate in Table 10 represents the effect of cash flow on cash holdings from a separate regression for a different sub-sample.

Column (1) reports the coefficient estimates on cash flow for the various measures of financial constraints. Column (1), row (1) shows that firms without access to lines of credit in all years of the sample save a positive amount of cash out of cash flow, a result that is statistically distinct from 0 at the 1 percent level. There is no such effect for firms that have access to bank lines of credit. The coefficient estimates for the two samples are statistically distinct from one another at the 10 percent level. The coefficient estimates in column (1), rows (2) through (5) replicate the procedure using the ACW (2004) measures of financial constraints. The ordering of the point estimates is consistent with their findings in every category except the bond rating categorization. However, in terms of statistical significance, the coefficient estimates on cash flow are statistically distinct in the constrained versus unconstrained samples for only the line of credit measure and the commercial paper measure. This suggests that access to lines of credit is a more powerful statistical measure of constraints than the payout ratio, the firm size measure, and the measure using bond ratings.

In columns (2) and (3) of Table 10, I examine whether the availability of lines of credit adds statistical power to the measures used in ACW (2004). For each of *their* measures of financial constraints, I split the "constrained" sample further based on whether the firm has access to a line of credit in every year of the sample. As the reported estimates in column (3) demonstrate, the positive effect of cash flow on cash holdings among *their* "constrained" firms is driven exclusively by "constrained" firms that do not have access to lines of credit. In other words, firms that ACW (2004) classify as constrained but have access to a line of credit show no statistically significant positive relationship between cash flow and cash holdings. Despite the small sample sizes, the coefficient estimates in columns (2) and (3) are statistically distinct from one another at the 4 percent level for the payout ratio categorization, and at the 13 percent level for both the bond ratings and the commercial paper ratings categorizations. The results suggest that firms that have access to a line of credit are not financially constrained, even if they are classified as constrained by the ACW (2004) measures. Overall,

the results in columns (2) and (3) suggest that the measures of financial constraints used in ACW (2004) are reasonable measures of financial constraints on average. However, a measure of the availability of bank lines of credit adds important information that improves the cash-cash flow sensitivity estimates.

VI. Conclusion

This paper empirically examines the distribution of bank lines of credit among corporations. It represents one of the first large-sample empirical examinations of what is the most widely used source of debt financing for public firms. It makes contributions to both the literature on bank lines of credit and the literature on cash and corporate liquidity management. With regard to the literature on bank lines of credit, I find that the supply of lines of credit by banks is particularly sensitive to the profitability of the borrower. Banks are less willing to extend lines of credit to firms with low historical profitability, and this result is strongest among firms with a higher probability of financial or economic distress. Firms in industries with seasonal sales patterns more heavily utilize bank lines of credit. While more informational opaque firms utilize all forms of bank debt more heavily, there does not appear to be a unique effect with bank lines of credit. Finally, the results presented here quantify the degree to which bank lines of credit provide unconditional liquidity insurance. Banks employ financial covenants on profitability, and reduce the availability of the unused portion when a firm violates covenants. However, the borrower typically retains a portion of the unused line of credit, and the borrower gains full access to the line of credit two years after the covenant default.

This paper also contributes to the literature on cash holdings and corporate liquidity. The existing literature maintains that firms that face difficulties in obtaining financing at a future date hold more cash balances, and save more cash out of cash flows. The existing literature does not address whether bank lines of credit can reduce future financial market frictions, and thus reduce the need to hold cash as a source of liquidity. My findings imply that bank lines of credit are an available substitute for cash in the liquidity management of only profitable firms with low probabilities of financial distress. Even among firms that obtain a line of credit, the line of credit is not a perfect substitute for cash in future states where profitability drops. Although theoretical research argues that bank lines of credit provide insurance

against frictions in future spot markets, the empirical findings presented here suggest that such insurance is available only to firms that maintain high profitability. I therefore identify a precise constraint that leads some firms to hold higher cash balances as liquidity protection: firms without access to a line of credit (due to low profitability) hold higher cash balances and save more cash out of cash flow.

The results presented here point to two avenues of future research. First, I find evidence that suggests that the supply of bank lines of credit is more sensitive to firm profitability than the supply of other types of debt instrument. As mentioned above, I view this result as preliminary. It may be the case that the flexibility of bank lines of credit makes them especially prone to abuse by management in times of financial or economic distress. Term bank debt or public sources of debt require intense investigation when an additional dollar of credit is extended, whereas borrowers can draw down quickly and easily on an existing line of credit. Potential abuse may explain why the supply of bank lines of credit appears to be more sensitive to firm profitability than other debt instruments. A theoretical framework is needed to formalize this intuition, and further empirical analysis is needed to confirm this evidence.

Second, I accept in this paper the argument in ACW (2004) that the cash flow sensitivity of cash is a measure of financial constraints, and not simply a proxy for the investment opportunities of the firm. The findings of this paper suggest that the ability to obtain a bank line of credit is a main determinant of whether firms show a higher cash flow sensitivity of cash. Does the inability to obtain a bank line of credit represent a "financial" constraint, or simply lower investment opportunities? In other words, is there a quantifiable capital market imperfection that leads some firms to be unable to obtain a bank line of credit? For example, it could be the case that information asymmetry between banks and borrowers is very severe; as a result banks place extremely tight covenants on lines of credit and ration credit to borrowers (who may have good projects) that have observably low historical profitability. The findings of this paper suggest that further research into possible frictions in the market for bank lines of credit may prove fruitful in understanding the nature of financial constraints.

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Figure Legends

Figure 1: Types of debt and profitability
This figure maps types of debt, scaled by total assets, against firm profitability. The measures of the type of debt are residuals from a regression relating types of debt to all firm characteristics except firm profitability. The x-axis is the 3-decile rolling average of profitability.

Figure 2
No additional explanation necessary

Figure 3: The effect of default on availability of lines of credit
This figure maps lines of credit, scaled by total assets, relative to the year when a firm experiences a default on its line of credit agreement. The sample includes all observations for firms that experience exactly one default over the sample period (49 firms).

Figure 1: Types of debt and profitability

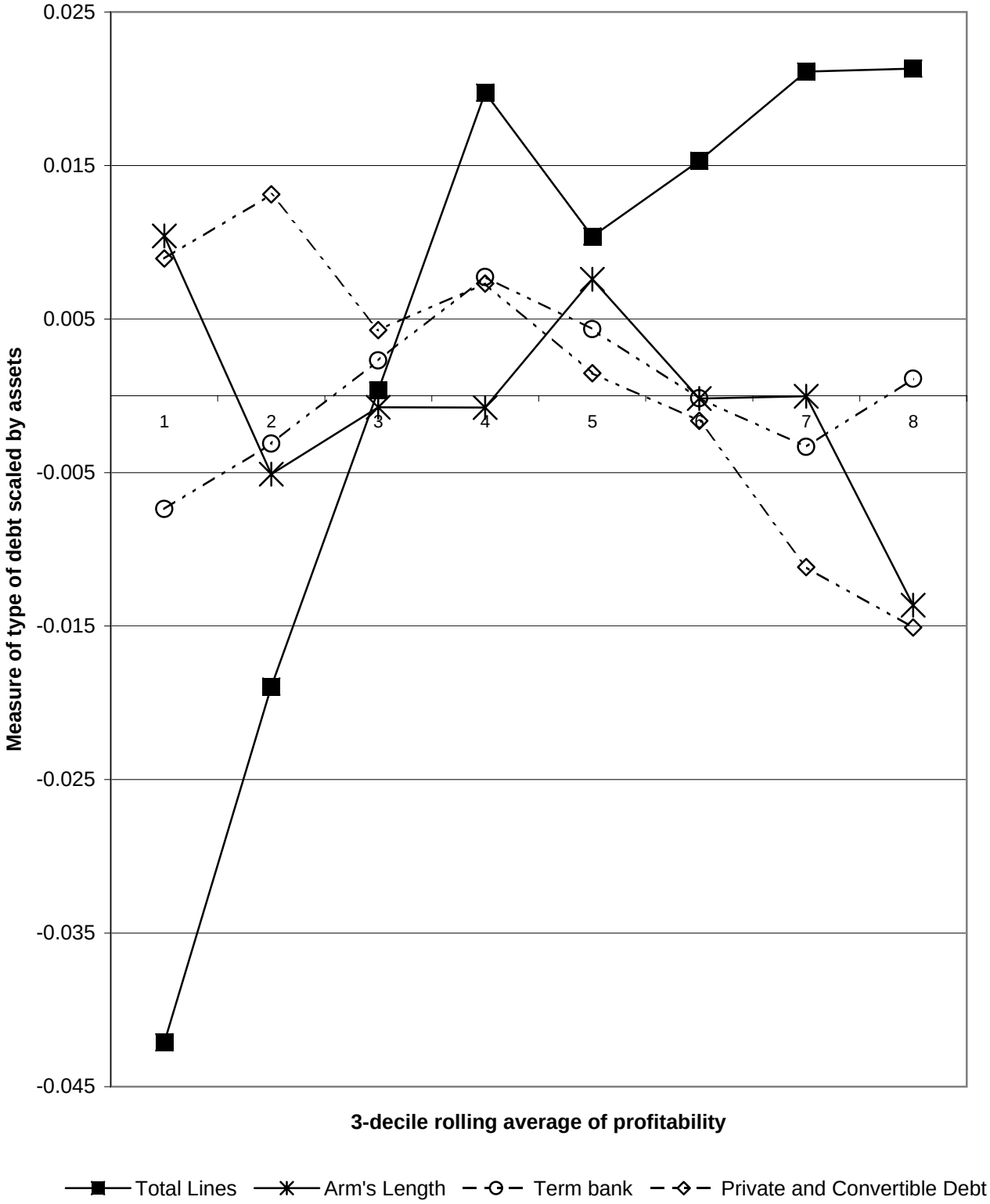
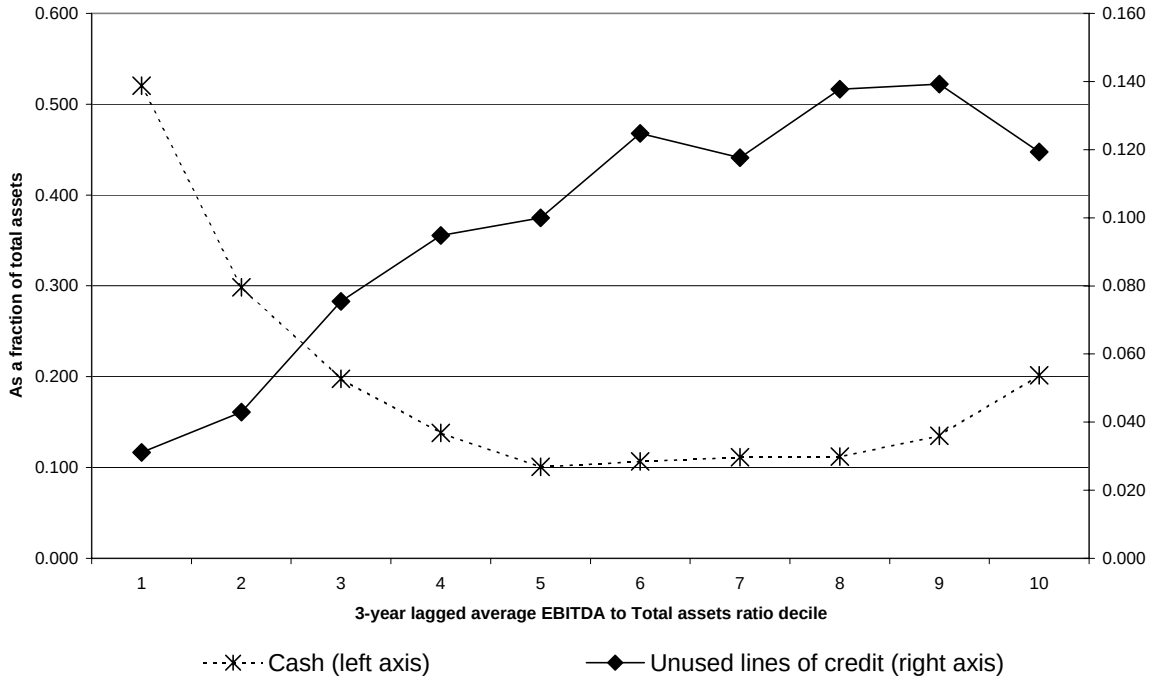


Figure 2

Panel A: Cash and unused lines of credit across the profitability distribution



Panel B: Unused lines of credit to unused lines of credit plus balance sheet cash ratio (Bank liquidity to total liquidity ratio)

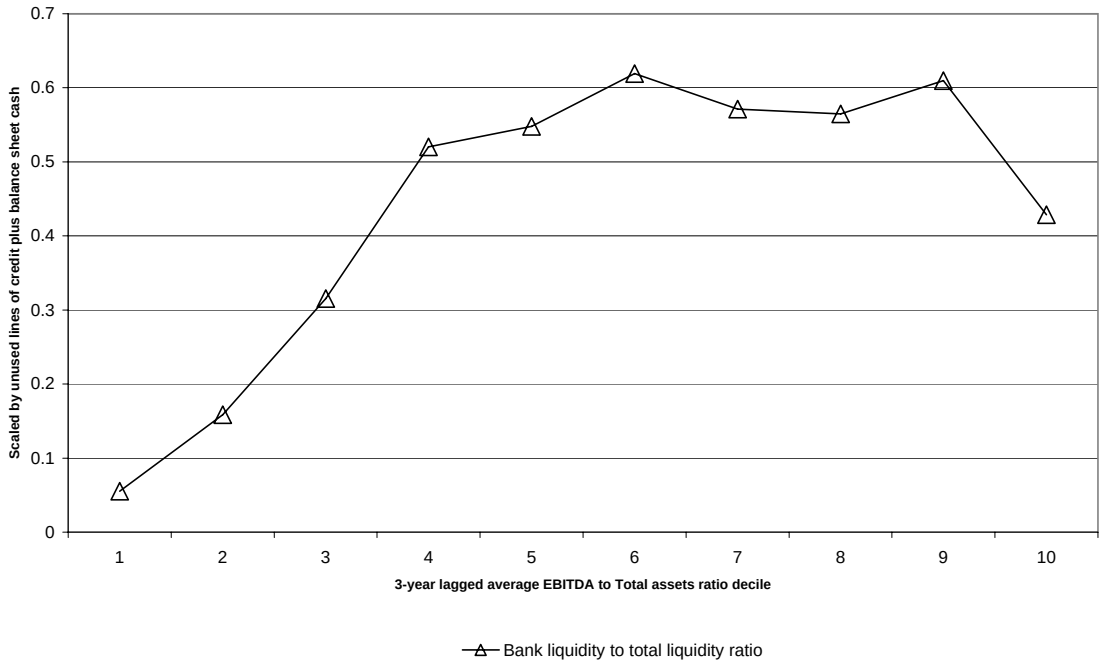


Figure 3: The effect of default on availability of lines of credit

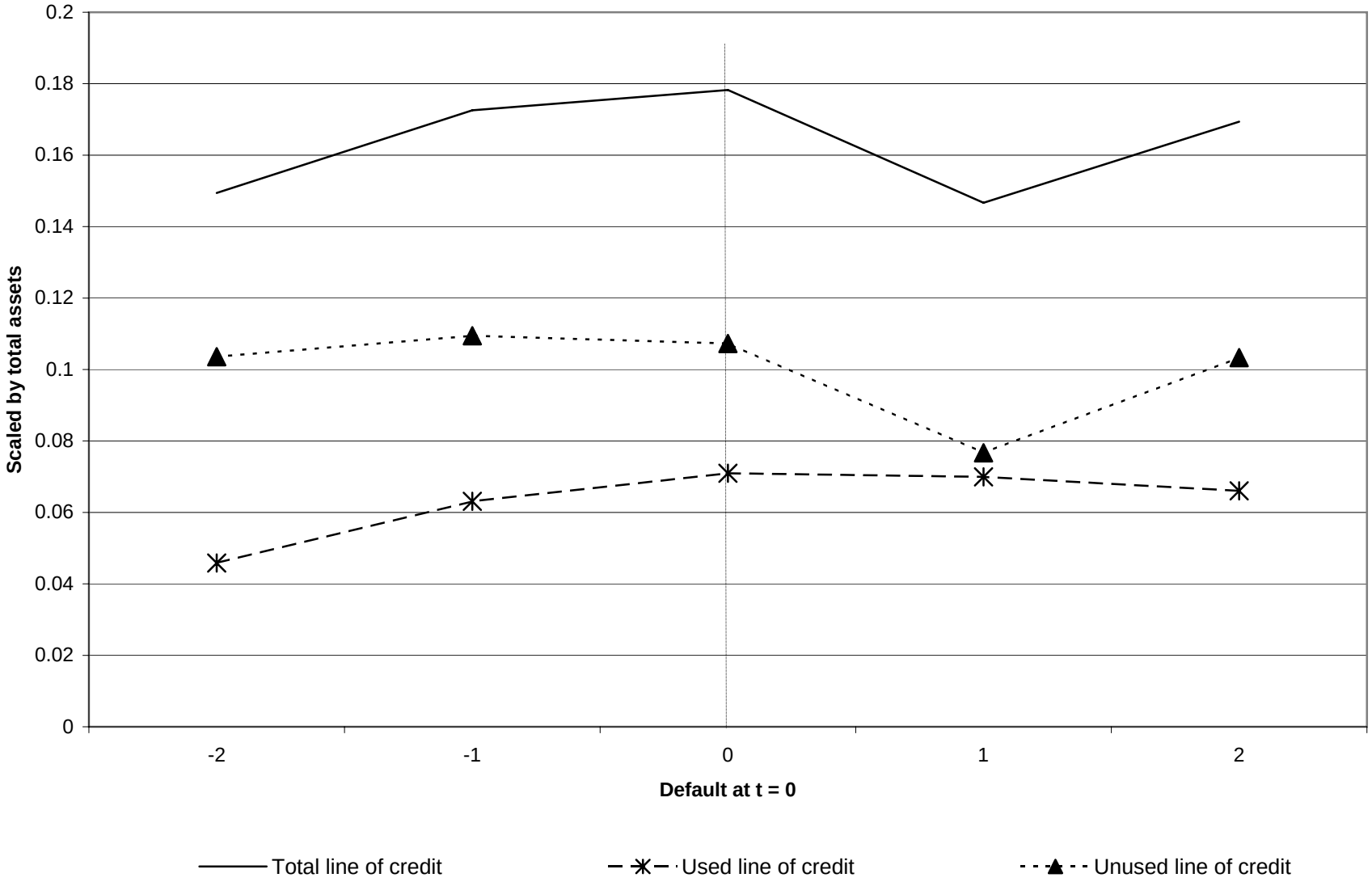


Table 1
Summary Statistics

This table presents summary statistics for a random sample of 300 firms from 1996 through 2003, for a total unbalanced panel of 1,916 firm-year observations. Data on lines of credit and the portfolio of debt come from direct examination of annual 10-K SEC filings. All other data are from Compustat. *Bank liquidity to total liquidity* is the ratio of unused bank lines of credit to the sum of unused bank lines of credit and balance sheet cash holdings.

	Mean	Standard Deviation	Fraction with type of debt
Lines of credit, scaled by total assets			
Total line of credit	0.154	0.168	0.735
Used line of credit	0.056	0.097	0.481
Unused line of credit	0.098	0.124	0.706
Bank liquidity to total liquidity	0.438	0.374	
Portfolio of debt, scaled by total assets			
Total debt	0.206	0.199	0.812
Used line of credit	0.056	0.097	0.481
Term bank debt	0.034	0.085	0.334
Arm's length debt	0.061	0.126	0.304
Public debt	0.032	0.091	0.142
Private placements	0.022	0.078	0.130
Industrial revenue bonds	0.004	0.016	0.115
Commercial paper	0.003	0.020	0.045
Convertible debt	0.019	0.070	0.134
Private non-bank debt	0.016	0.056	0.224
Capitalized leases	0.007	0.026	0.330
Other debt	0.014	0.042	0.397
Earnings measures			
EBITDA/assets	0.055	0.221	
Average of 3-year lagged EBITDA/assets	0.058	0.213	
Variability measures			
3-digit SIC within-year sales variance			
EBITDA variance (Mackie-Mason)	0.092	0.109	
Measures of information asymmetry			
Equity traded over the counter	0.141	0.348	
NOT in S&P 500, mid 400, or small 600	0.689	0.463	
Firm age (years since IPO)	14.2	12.5	
Other firm characteristics			
Market to book ratio	2.017	1.875	
Tangible assets to total assets ratio	0.279	0.220	
Total sales ($M)	1503	5034	

Table 2
Cross-Utilization Patterns For Types of Debt

This table presents cross-utilization rates for different types of debt. The columns represent the conditional sample, and the rows represent which other types of debt firms in the conditional sample have. For example the figure in column 1, row 4 means that a fraction of 0.400 firms that have a line of credit also have outstanding term bank debt.

	Conditional on having:			
	Line of credit	Term bank debt	Arm's length debt	No debt
Also have:				
Line of credit	1.000	0.880	0.960	0.300
Used portion of line of credit	0.654	0.673	0.627	0.000
Unused portion of line of credit	0.960	0.822	0.943	0.300
Term bank debt	0.400	1.000	0.419	0.000
Arm's length debt	0.397	0.381	1.000	0.000
No debt	0.077	0.000	0.000	1.000

Table 3
Line of Credit to Total Assets Ratio and Borrower Characteristics

This table presents coefficient estimates for pooled regressions relating lines of credit to characteristics of the firm. All dependent variables in columns (1) through (5) are scaled by total assets. Dependent variables in columns (6) and (7) are scaled by total debt, and the sample includes only firm-year observations where the book debt to assets ratio is at least 0.05. All regressions include year and industry indicator variables. Standard errors are heteroskedasticity-robust, clustered at the firm.

	Scaled by Total Assets, Full Sample					**Scaled by Total Debt, Debt to Assets >= 0.05**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	Total line	Used line	Unused line	Term bank	Arm's length	Used line	Unused line
Measure of profitability							
Average of 3-year lagged EBITDA/assets	0.150**	0.054**	0.096**	0.029	-0.118**	0.540**	1.160**
	(0.038)	(0.018)	(0.029)	(0.017)	(0.023)	(0.126)	(0.392)
Measure of business variability							
3-digit SIC within-year sales variance	0.534*	0.043	0.491*	-0.095	0.008	0.125	2.978
	(0.232)	(0.112)	(0.219)	(0.091)	(0.187)	(0.476)	(1.855)
EBITDA variance	-0.045	-0.054	0.009	-0.070**	-0.011	0.219	1.279
	(0.063)	(0.032)	(0.050)	(0.024)	(0.025)	(0.196)	(1.003)
Market to book ratio (lagged)	-0.008**	-0.004**	-0.005**	-0.003**	-0.002	0.005	-0.005
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.009)	(0.021)
Measure of information asymmetry							
Equity traded over the counter	0.006	0.032	-0.026*	0.031*	-0.001	-0.038	-0.274*
	(0.023)	(0.018)	(0.012)	(0.012)	(0.010)	(0.049)	(0.127)
NOT in S&P 500, mid 400, or small 600	0.057**	0.039**	0.018	0.036**	0.014	0.058	-0.100
	(0.017)	(0.009)	(0.013)	(0.010)	(0.015)	(0.045)	(0.087)
Ln[1+Firm age (years since IPO)]	-0.049**	-0.024**	-0.025**	-0.013**	0.017*	-0.076**	-0.097*
	(0.008)	(0.005)	(0.006)	(0.005)	(0.008)	(0.022)	(0.044)
Other firm characteristics							
Tangible assets to total assets ratio (lagged)	0.081*	0.046	0.035	0.021	0.060	-0.100	-0.322
	(0.037)	(0.025)	(0.025)	(0.023)	(0.040)	(0.090)	(0.206)
Ln[Total sales ($M)] (lagged)	0.015**	0.006*	0.009**	0.006	0.032**	-0.017	-0.017
	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)	(0.011)	(0.022)
N	1916	1916	1916	1916	1916	1260	1260
R^2	0.21	0.16	0.15	0.09	0.38	0.16	0.10

**, * signify that the coefficient estimate is significantly different than 0 at the 1 and 5 percent confidence level, respectively

Table 4
Bank Liquidity to Total Liquidity Ratio and Borrower Characteristics

This table presents coefficient estimates for pooled and fixed effects regressions relating the unused line of credit to unused line of credit plus balance sheet cash ratio (the bank liquidity to total liquidity ratio) to characteristics of the firm. Columns (2) and (3) split the sample based on the non-line of credit debt to total assets ratio (*D/A*) of the firm-year observation. Columns (4) and (5) split the sample based on Altman's Z-probability of default. Column (6) reports the fixed effects coefficient estimates. All regressions include year and industry indicator variables. Standard errors are heteroskedasticity-robust, clustered at the firm.

			Pooled regressions			Fixed effects
	(1)	(2)	(3)	(4)	(5)	(6)
Sample:	Full	High non-line debt	Low non-line debt	High probability of default	Low probability of default	Full
Dep. Variable (scaled by total liquidity):	Bank liquidity	Bank liquidity	Bank liquidity	Bank liquidity	Bank liquidity	Bank liquidity
Measure of profitability						
Average of 3-year lagged EBITDA/assets	0.188*	0.565**	0.128	0.234**	0.024	
	(0.076)	(0.115)	(0.095)	(0.085)	(0.229)	
EBITDA/assets						0.135**
						(0.049)
Measure of business variability						
3-digit SIC within-year sales variance	0.958*	1.129**	0.992	1.388*	0.232	0.551
	(0.418)	(0.432)	(0.719)	(0.666)	(0.536)	(0.346)
EBITDA variance	-0.237*	-0.174	-0.196	-0.124	-0.553*	-0.109
	(0.121)	(0.307)	(0.119)	(0.114)	(0.242)	(0.142)
Market to book ratio (lagged)	-0.020**	-0.025	-0.013*	-0.011*	-0.034**	-0.002
	(0.006)	(0.015)	(0.005)	(0.005)	(0.011)	(0.002)
Measure of information asymmetry						
Equity traded over the counter	0.038	-0.044	0.096	0.011	0.122	
	(0.043)	(0.060)	(0.051)	(0.047)	(0.089)	
NOT in S&P 500, mid 400, or small 600	0.069	-0.016	0.147**	0.026	0.098*	
	(0.038)	(0.040)	(0.053)	(0.055)	(0.049)	
Ln[1+Firm age (years since IPO)]	-0.023	-0.023	-0.027	-0.020	-0.060*	
	(0.017)	(0.020)	(0.025)	(0.025)	(0.024)	
Other firm characteristics						
Tangible assets to total assets ratio (lagged)	0.265**	0.065	0.387**	0.172	0.481**	0.288*
	(0.080)	(0.086)	(0.132)	(0.097)	(0.135)	(0.112)
Ln[Total sales ($M)] (lagged)	0.067**	0.046**	0.065**	0.056**	0.074**	-0.002
	(0.009)	(0.011)	(0.017)	(0.011)	(0.015)	(0.015)
N	1916	958	958	930	931	983
R^2	0.37	0.34	0.34	0.41	0.32	0.60

**, * signify that the coefficient estimate is significantly different than 0 at the 1 and 5 percent confidence level, respectively

Table 5
Covenant Data from Dealscan

This table presents the fraction of lines of credit that have various types of financial covenants. The sample includes 19,523 sole lender and syndicated lines of credit obtained by non-financial businesses from 1996 to 2003, and comes from Dealscan by the Loan Pricing Corporation. Lines of credit can have more than one type of financial covenant.

Type of covenant	Fraction of loans	Type of covenant	Fraction of loans	Type of covenant	Fraction of loans
Cash flow/profitability based	0.381	Net worth based	0.232	Balance sheet based	0.192
Fixed charge coverage	0.180	Total net worth	0.122	Leverage ratio	0.064
Debt service coverage	0.060	Financial net worth	0.110	Current ratio	0.084
Interest coverage	0.185			Debt to equity	0.005
Cash interest coverage	0.009			Debt to total net worth	0.073
Debt to cash flow	0.237				
Senior debt to cash flow	0.045				
Any financial covenant	**0.487**				

Table 6
Covenant Default Data from Annual 10-K SEC Filings

This table presents the fraction of firm-year observations in the random sample of 300 firms (1,916 firm-year observations) where a "default" on a debt agreement has taken place. Any missed interest payment or technical financial covenant violation is considered a default. In brackets, I report the fraction of firm-year observations with a default on the type of debt in question *conditional* on the firm-year having the type of debt in question.

Any	Line of credit	Term bank	Arm's length	Non-bank private	Convertible
0.092	0.079	0.033	0.002	0.006	0.001
	[0.107]	[0.093]	[0.007]	[0.026]	[0.008]

Table 7
Covenant Defaults and Firm Characteristics

This table presents coefficient estimates from fixed effects regressions relating the probability of default to characteristics of the firm. The sample includes all firm-year observations where the firm has a line of credit

Dependent Variable	(1) $Default_t$	(2) $Default_t$	(3) $Default_t$
$(EBITDA/assets)_t$	-0.531**	-0.369*	-0.355*
	(0.151)	(0.156)	(0.157)
$(Net\ worth/assets)_t$		-0.019*	-0.019*
		(0.007)	(0.008)
$(Book\ debt/assets)_t$		0.441**	
		(0.134)	
$(Used\ line/assets)_t$			0.586**
			(0.207)
$(Term\ bank/assets)_t$			0.537**
			(0.188)
$(Arm's\ length/assets)_t$			0.172
			(0.191)
$(Other\ debt/assets)_t$			0.371
			(0.255)
N	1409	1409	1409
R^2	0.23	0.25	0.25

**,* signify that the coefficient estimate is significantly different that 0 at the 1 and 5 percent confidence level

Table 8
The Effect of Default on Availability of Line of Credit

This table presents coefficient estimates from fixed effects regressions relating the availability of a firm's line of credit at time *t* to a default at *t-1*. The sample includes all firm-year observations where the firm has a line of credit at *t-1* and where the firm has at most 1 covenant default in the sample.

Dependent Variable	(1) $(Total\ line/assets)_t$	(2) $(Unused\ line/assets)_t$	(3) $(Total\ line/assets)_t$	(4) $(Unused\ line/assets)_t$
$Default_{t-1}$	-0.042*	-0.039**	-0.043+	-0.041**,+
	(0.022)	(0.014)	(0.024)	(0.016)
$Default_{t-2}$			-0.002+	-0.011+
			(0.024)	(0.020)
$(EBITDA/assets)_{t-1}$	0.056	0.113	0.056	0.112
	(0.067)	(0.063)	(0.067)	(0.063)
$Market\ to\ book_{t-1}$	-0.001	-0.005	-0.001	-0.005
	(0.003)	(0.003)	(0.003)	(0.003)
$(Tangible\ assets/assets)_{t-1}$	0.098	-0.022	0.098	-0.024
	(0.065)	(0.072)	(0.066)	(0.072)
$Ln(firm\ sales)_{t-1}$	0.011	-0.004	0.011	-0.004
	(0.014)	(0.013)	(0.014)	(0.014)
N	995	995	995	995
R^2	0.70	0.58	0.70	0.58

**,* signify that the coefficient estimate is significantly different that 0 at the 1 and 5 percent confidence level
+ signifies that coefficients are distinct from each other at 10 percent level.

Table 9
Correlation with Other Measures of Financial Constraints

	Access to line of credit	Payout decile	Size decile	Bond rating
Payout ratio decile	0.243			
Size decile	0.288	0.360		
Bond rating	0.244	0.245	0.681	
CP rating	0.185	0.292	0.416	0.475

*Note: All correlations are statistically distinct from 0 at the 1 percent level.

Table 10
Availability of Bank Lines of Credit and the Cash Flow Sensitivity of Cash

This table presents coefficient estimates from regressions relating the change in cash holdings to cash flow. The estimation follows that of Almeida, Campello, and Weisbach (2004), which they describe in their equation (8) and Table III. Each reported coefficient is the effect of cash flow on cash holdings from a separate regression. All estimations include year and firm fixed effects. Standard errors are heteroskesticity-robust, clustered at the firm.

Dependent variable
Δ Cash Holdings

	(1)	(2) Line of credit available in all years	(3) Line of credit NOT available in all years
1. Lines of credit			
Available in all years	0.020		
	(0.041)		
Not available in all years	0.117**,+		
	(0.043)		
2. Payout ratio			
Highest 3 deciles	0.027		
	(0.112)		
Lowest 3 deciles	0.136*	-0.010	0.164**,^
	(0.053)	(0.056)	(0.066)
3. Firm size (assets)			
Largest 3 deciles	0.013		
	(0.078)		
Smallest 3 deciles	0.112*	0.039	0.129*
	(0.051)	(0.057)	(0.064)
4. Bond ratings			
Has a rating	0.102		
	(0.117)		
Does not have a rating	0.092**	0.027	0.115**
	(0.035)	(0.045)	(0.044)
5. Commercial paper ratings			
Has a rating	-0.202		
	(0.136)		
Does not have a rating	0.091**,+	0.027	0.116**
	(0.033)	(0.041)	(0.043)

**,* distinct from 0 at 1 and 5 percent, respectively; + distinct from unconstrained sample at 10 percent or better, ^ distinct from constrained sample with line of credit available in all years at 10 percent or better

DATA APPENDIX

In this data appendix, I provide additional detail into how the data are collected and categorized from annual 10-K SEC filings of corporations. In the first section, I describe in detail how the debt data are categorized. In the second section, I conduct a few comparisons and tests to validate the data collection procedure.

A. Categorization of debt claims

Overall, I gather information on the sources of debt from three locations. First, the grand majority of debt items are detailed directly on the annual 10-K SEC filing. Second, the exhibits (8-K filings) that describe debt issues and loans often relay the precise source of debt obligations. Finally, I use the SDC Platinum database to distinguish public debt from private placements.

Bank debt includes any debt instrument from a bank or financing company. It also includes a small number debt items that are not explicitly listed as being from a bank or financing company. More specifically, there are a small number of equipment loans, loan and security agreements, and overdrafts that are counted as bank debt. In addition, there are a small number of lines of credit (4 percent of all firm-year observations where a line of credit is present) where the source is not available. These are counted as bank debt.

For lines of credit, the firm must discuss the line of credit in the liquidity and capital resources section or the debt financial footnotes for the line of credit to be included in the analysis. "Informal" or "uncommitted" lines of credit are not considered lines of credit. Lines of credit from non-financial institutions are extremely rare and are usually from related parties or related affiliates. These are not considered lines of credit, and are instead included in private non-bank debt. In addition, I do not include in my measure of bank lines of credit leasing lines of credit, vendor credit lines, or equity lines of credit. If the firm has multiple bank lines of credit, I aggregate them.

Non-bank private debt includes debt from vendors, related parties, sellers, customers, shareholders, and insurance companies. It also includes vendor finance obligations, floor plan notes, not to compete related debt, arbitration payments, and most debt related to acquisition payments. Promissory notes that are not explicitly defined as being from financial institutions or from a disperse set of debt-holders are categorized as non-bank private debt. Non-bank private debt also includes private placements that are issued to 2 or fewer parties.

I distinguish public debt issues from private placements using three sources: language directly from annual 10-K SEC filings, the 8-K exhibits of the company, and the "Market" field in SDC Platinum data base. If I cannot distinguish between a private placement and a public debt issue because they are aggregated, I count the debt as public debt.

B. Data collection validity tests

In order to provide a base line comparison for the data collection, I directly compare the summary statistics from Houston and James (1996) with the summary statistics from this paper. There are several differences in the sample construction between Houston and James (1996) and this paper. First, Houston and James (1996) analyze only companies that have equity listed on the New York Stock Exchange, the American Stock Exchange, or the National Association of Securities Dealers. Second, Houston and James (1996) include only firms with some long term debt outstanding. Finally, the Houston and James (1996) sample covers an earlier time period; they evaluate 250 firms in 1980, 1985, and 1990.

Appendix Table 1 compares the summary statistics of their paper and my paper, after making the necessary adjustments in my sample to make the samples comparable. The leverage ratio of firms in my sample is lower (0.25 versus 0.39) and the market to book ratios are slightly higher (1.66 versus 1.38). The public debt to total debt ratio, and the commercial paper to total debt ratio both are very similar. In addition, the unused lines of credit to total assets ratio is very similar across both samples. There is an important discrepancy in the bank debt to total debt ratio. Houston and James (1996) report a higher statistic (0.64) than the comparable statistic in

my sample (0.48). As they note, their measure of bank borrowing includes "private borrowing where the identity of the lender is not provided," and that "as a result, [their] measure of bank borrowing is likely to overstate the amount of borrowing from commercial banks" (1870). The difference appears to be made up in my sample with private placements and convertible debt.

I also test the validity of the data collection procedure using data directly from Compustat. The Compustat database contains a measure of convertible debt (*item 79*) and capitalized leases (*item 84*). However, the Compustat measures include only convertible debt and capitalized leases that are in the long-term portion of debt. My data collection procedure collects both short-term and long-term convertible debt and capitalized leases. In Appendix Table II, I report the coefficient estimate from regressing the natural logarithm of 1 + the Compustat measures on the natural logarithm of 1 + my measures. As is expected, the coefficients are less than 1; the Compustat figures do not include *short-term* convertible debt or capitalized leases and are therefore expected to be smaller. Nonetheless, the coefficient estimates are strong both in magnitude and statistical significance. The *t*-statistics are between 8 and 10 in both specifications, and the R^2 is above 0.83 for convertible debt and 0.73 for capitalized leases. Overall, the measures of fitness and statistical significance of the coefficient estimates imply that the data match the Compustat data closely.

Appendix Table I
This paper versus Houston and James (1996)

This table directly compares the summary statistics in Houston and James (1996) with this paper, where the latter sample is adjusted to most closely replicate that of the former. The sample includes only firms that are on the NYSE, American Exchange, or NASDAQ. The sample includes only firms with some long term debt (*item 9*). Total debt equals short plus long term debt less industrial revenue bonds, mortgages, and capitalized leases.

	Houston and James (1996)		This paper	
	Mean	Median	Mean	Median
Leverage	0.39	0.35	0.25	0.24
Market to book	1.38	1.08	1.66	1.34
Bank debt/total debt	0.64	0.77	0.48	0.42
Public debt/total debt	0.15	0.00	0.15	0.00
Commercial paper/total debt	0.02	0.00	0.01	0.00
Other private/total debt	0.13	0.01	0.08	0.00
Private placements/total debt			0.10	0.00
Convertible debt/total debt			0.09	0.00
Unused lines of credit/assets	0.13	0.07	0.12	0.09
Percent with public debt	39		23	
Percent with commercial paper	7.6		7.0	

Appendix Table II
This paper versus Compustat

This table directly compares the convertible debt and capitalized leases data collected from 10-K's in this paper with data available from Compustat. Compustat *item 79* and *item 84* record convertible long term debt and long-term debt in the form of capitalized leases. In each column, the natural logarithm of 1 + the Compustat measures is regressed on the natural logarithm of 1 + the collected data from this paper.

	Ln[1+CStat Conv. debt]	Ln[1+CStat Capitalized Leases]
Ln[1+This paper Conv. Debt]		
Coefficient	0.84	
Standard Error	(0.009)	
R^2	0.83	
Ln[1+This paper Capitalized Leases]		
Coefficient		0.81
Standard Error		(0.011)
R^2		0.73